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(54) Portable power tool having low rate, rechargeable batteries

(57) The present invention is directed to a portable power tool having an electric power tool, a low weighted battery pack and a cable interconnecting the pack to the tool. The pack is remote from the tool, attached to an article of clothing such as a belt or a vest.

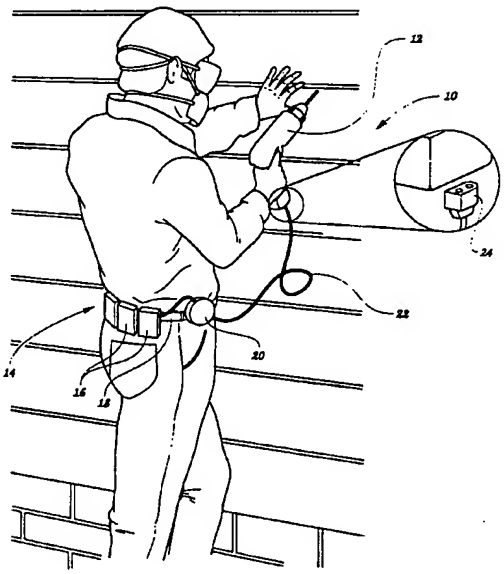

Fig. 1

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Description

Field of the Invention

[0001] This invention is directed to portable power tools having low rate, rechargeable batteries.

Background of the Invention

[0002] Portable power tools having high rate, rechargeable batteries are commercially available. A high rate and rechargeable battery is a nickel cadmium (NiCd) battery. A high rate battery is one that is capable of discharging its entire energy capacity in a relatively short period of time. Tools using high rate batteries are, however, limited because the charge in the high rate battery can be dissipated quickly as a result of use. This requires that the battery be frequently recharged or that additional battery packs be provided if prolonged use is desired. Others have proposed that the useable life of the nickel cadmium battery pack can be extended by mounting additional batteries on articles of clothing. See U.S. Patent Nos. 3,919,615 and 5,680,026. This solution, however, is obtained at the expense of increased weight arising from additional batteries.

[0003] Low rate batteries, for example, lithium ion (Li ion) or nickel metal hydride (NiHM) batteries, are commercially available. But, their use is confined to portable electronic devices, such as telephones, computers and pagers, and their use in power tools has not been suggested because these batteries are unable to provide the current density required to operate a tool.

[0004] Accordingly, there is a need to provide a power tool that can be operated for greater lengths of time without dramatic increases in the weight of the tool.

Summary of the Invention

[0005] The present invention is directed to a portable power tool having an electric power tool, a low rate battery pack and a cable interconnecting the pack to the tool. The pack is remote from the tool.

Description of the Drawings

[0006] For the purpose of illustrating the invention, there is shown in the drawings a form which is presenting preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

Figure 1 is an illustration of an embodiment of the present invention in use by a worker.

Figure 2 is an illustration of another embodiment of the present invention in use by a worker.

Figure 3 is an illustration of the battery pack portion of the present invention as it may be embodied on a belt.

Detailed Description of the Invention

[0007] Referring to the drawings, wherein like numerals indicate like elements, there is shown in Figure 1 a portable power tool 10 and in Figure 2 a portable power tool 30. Portable power tools 10 and 30 comprise an electric tool 12, a battery pack 14/32 and a cable 22.

[0008] Electric tool 12 is illustrated as a drill, but is not so limited. Other electric tools include, but are not limited to, saws, grinding tools, polishing tools, lawn care tools, garden tools, video equipment, audio equipment, testing equipment, military equipment, and the like.

[0009] Battery pack 14 in Figure 1 is illustrated on a belt 18. Battery pack 14 in Figure 2 is illustrated on a vest 34. On both articles of clothing, low rate batteries 16 are mounted on the article of clothing. These low rate batteries, discussed below in greater detail, are electrically connected in parallel. The belt 18 or vest 34 are a conventional design. Figure 3 illustrates the battery pack in belt form.

[0010] Cable 22 electrically connects battery pack 14/32 to power tool 12. The exploded portion of Figure 1 illustrates a detachable connector 24, but any suitable connector may be used. Preferably, cable 22 may be mounted on reel 20. Reel 20 is a retractable device, as is well known, and is used to contain cable 22 when it is not in use. Preferably, cable 22 may be cut-resistant (e.g., metal clad), as is well known.

[0011] Low rate batteries refers to a battery that delivers its full energy capacity over a long period of time (e.g., > 1 hour), but cannot deliver a significant fraction of its capacity over a short period (e.g., 5 minutes) . In contrast, a high

rate battery refers to a battery that delivers its full energy capacity over a short period. To illustrate the foregoing, a high rate battery (e.g., a NiCd cell) will be compared to two low rate batteries (e.g., Li ion and NiMH).

TABLE 1

	NiCd	Li ion	NiMH
Nominal voltage (V)	1.2	3.6	1.2
Energy density Watt hour/kg (Wh/kg)	35	110	50
Watt hour/Liter	80	260	175

(from Linden, P., editor, Handbook of Batteries, 2ed, McGraw-Hill, New York 1995).

[0012] First, consider a 20 watt electric tool and batteries (NiCd, Li ion and NiMH) of equivalent volume. A 1.32 watt hour (Whr) NiCd battery would operate the tool for about 3 minutes and utilize about 80% of its capacity; a 4.29 Whr Li ion battery would operate for about 1.3 minutes and utilize about 10% of its capacity; and a 2.89 Whr NiMH battery would operate for about 1.7 minutes and utilize about 20% of its capacity. Accordingly, low rate batteries cannot be effectively used on portable power tools if they are mounted on the tool.

[0013] Second, consider the same 20 watt tool, but larger volume low rate batteries. If the foregoing Li ion battery is tripled in volume, then it will deliver 12.9 Whr and operate the tool for 38.6 minutes. In contrast, making the NiCd three times larger would only increase the run time to 11.9 minutes. To make the NiCd cell equivalent in run time to the Li ion all, the NiCd cell would have to be ten times larger in volume. On the equivalent run time basis (i.e., 38.6 minutes), the NiCd cell would weight about three times the Li ion cell (i.e., NiCd 0.37 kg vs Li ion - 0.12 kg).

[0014] The present invention may be embodied in other specific forms without disparting from the spirit or central attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specifications, as indicating the scope of the invention.

Claims

1. A portable power tool comprising:

   an electric power tool;

   a low rate battery pack, said battery pack being remote from said tools; and

   a cable interconnecting said pack to said tool.

2. The tool of claim 1 wherein said low rate battery pack is selected from the group consisting of lithium ion batteries and nickel metal hydride batteries.

3. The tool of claim 1 wherein said cable being detactable connectable to said tool.

4. The tool of claim 1 wherein said cable being retractable mounted on said pack.

5. The tool of claim 1 for the comprising said cable having means for resisting cutting.

6. A portable battery pack comprising:

   a plurality of low rate, light weight batteries connected in parallel; and

   an article of clothing, said batteries being attached thereto.

7. The pack according to claim 6 wherein said low rate batteries are selecting from the group consisting of lithium ion batteries and nickel metal hydride batteries.

8. The pack according to claim 6 wherein said article of clothing is selected from the group consisting of a belt or vest.

9. The pack according to claim 6 further comprising:

a cable being an electrical communication with said batteries.

10. The pack according to claim 9 further comprising:

a reel, said cable being carried on said reel and said reel being mounted on said article of clothing.

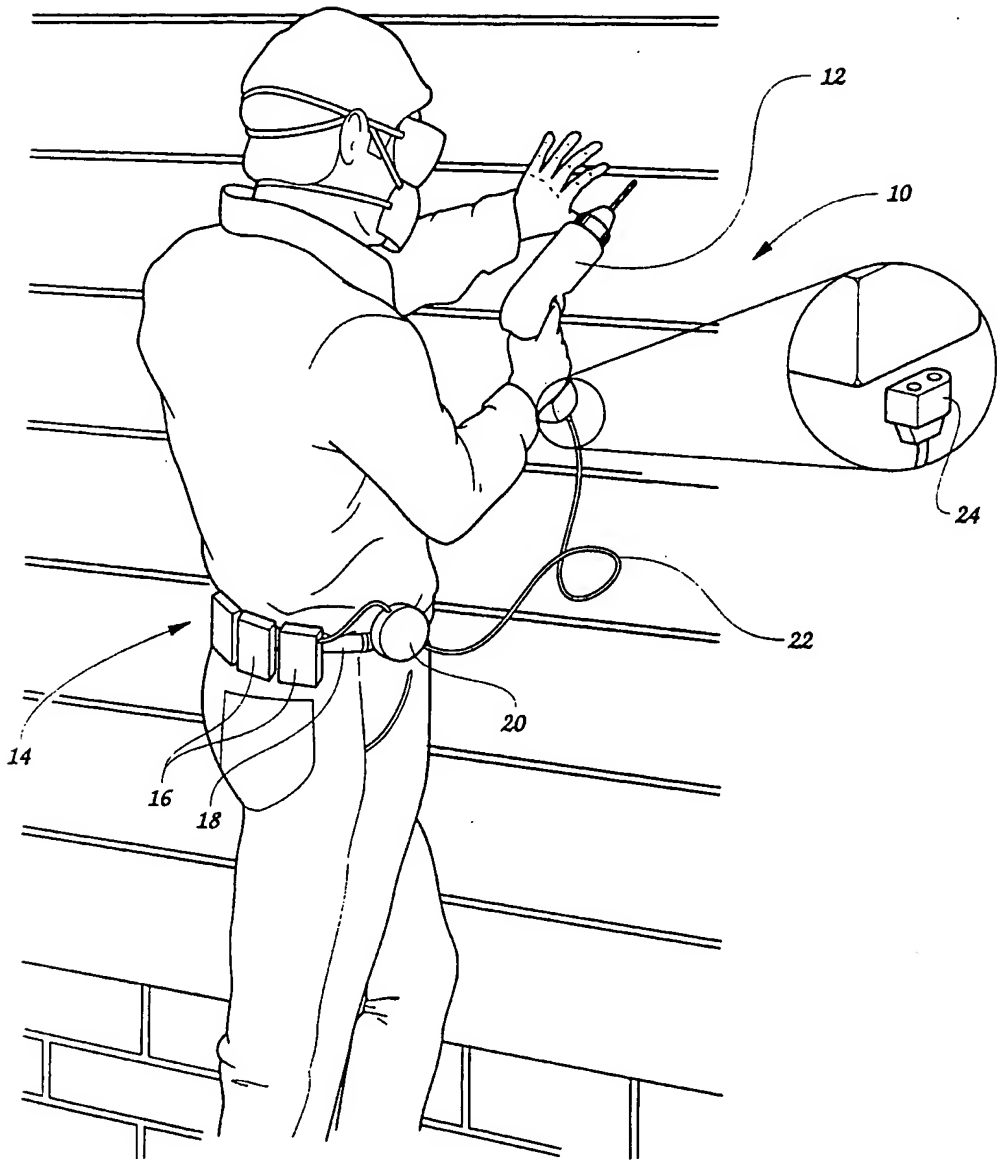

Fig. 1

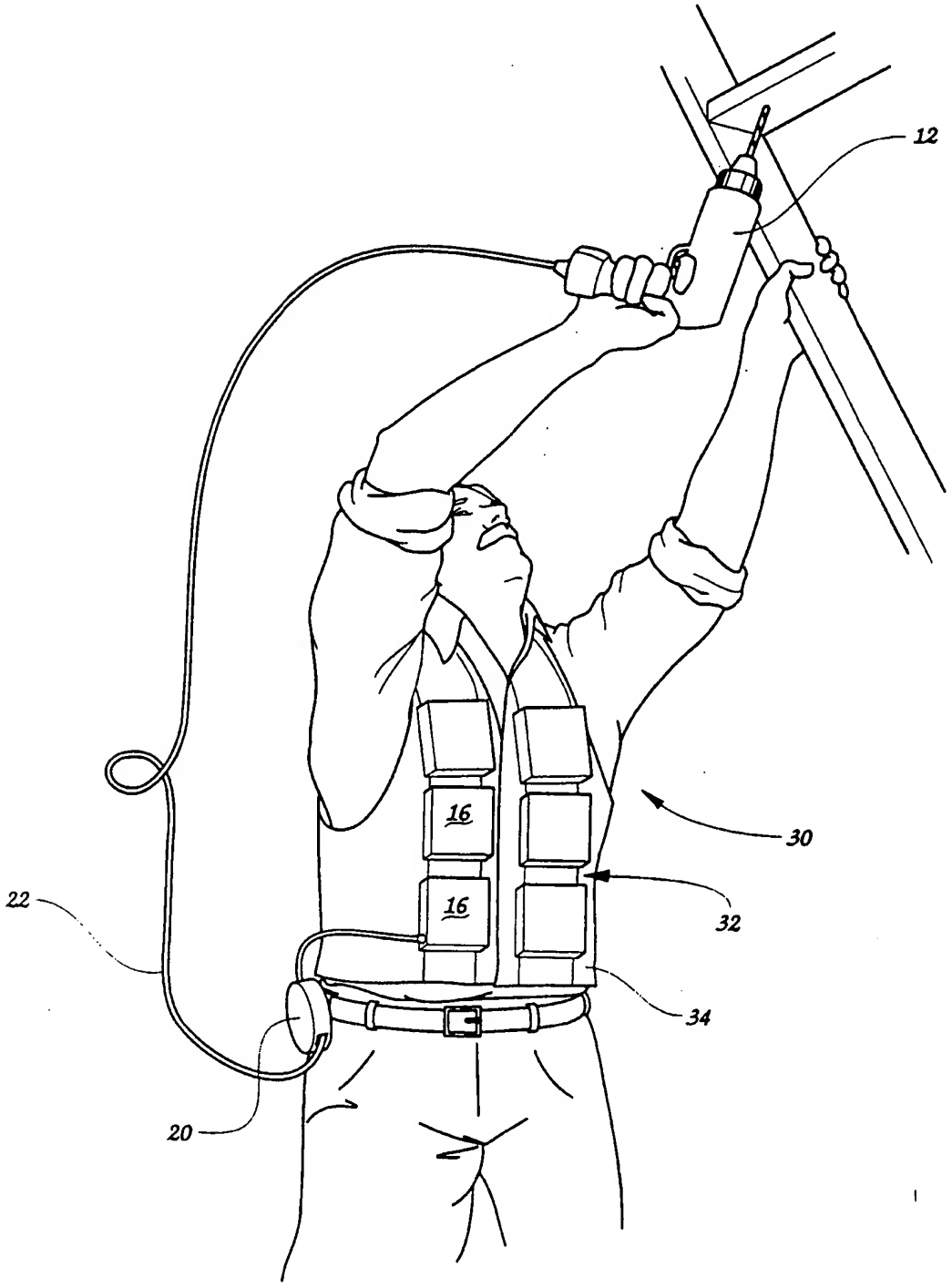

Fig. 2

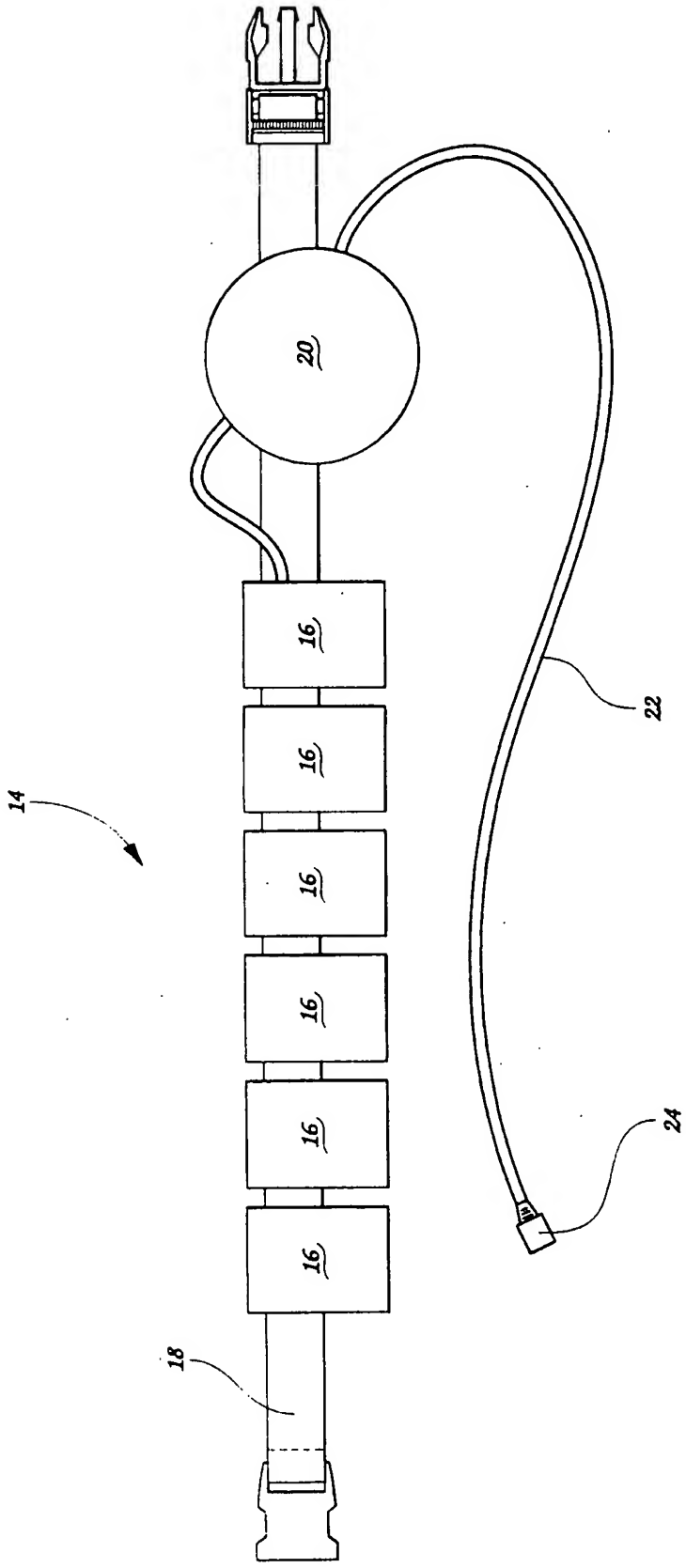

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 98 12 1802

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	US 5 510 690 A (TANAKA YOICHIRO ET AL) 23 April 1996 * column 1, line 30 - line 40; figures 5A,5B * * column 1, line 51 - column 2, line 30 * * column 4, line 1 - line 33 * * column 11, line 1 - line 6 *	6-9 10	H01M2/10
Y	DE 297 06 913 U (KUEFFNER GEORG DIPL ING FH) 5 June 1997 * claims 1,5,6 *	10	
Y	EP 0 689 255 A (FUJI PHOTO FILM CO LTD) 27 December 1995 * page 5, line 28 - page 6, line 6 * * page 7, line 1 - line 15 * * page 13, line 38 *	1-4	
D,Y	US 5 680 026 A (LUESCHEN WILLIAM K) 21 October 1997 * claims 1-30; figure 5 *	1-5	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
Y	WO 84 00133 A (AHAROUNI SHAOUL) 19 January 1984 * page 2, line 1 - line 2 *	5	H01M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 February 1999	Battistig, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 12 1802

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82